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SCIENCE
OF
LIFE INSURANCE.
BY
PETER WATT.

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PROGRESS AND PRESENT STATE
OF THE
SCIENCE OF LIFE INSURANCE,
WITH
THERMOMETRICAL TABLES.
ALSO,
OBSERVATIONS
ON
HEALTH INSURANCE, &c.



By PETER WATT,
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CHAPTER I.

THE ORIGIN OF THE SCIENCE OF LIFE INSURANCE, WITH
ITS PROGRESS DURING THE EIGHTEENTH AND FIRST
QUARTER OF THE NINETEENTH CENTURY.

I. THE uncertainty attendant on any particular individual enjoying a life-income, succeeding to an entailed estate, or obtaining possession of a sum of money life-rented by another, naturally led the person to look abroad for some mode of *securing* the reversion or continuance in possession of the life-income, or an equivalent for the loss to his heirs. The general exposure of a great number of such persons to one common danger, and the example of successful insurance by *average premiums*, against risks *at sea*, led, no doubt, to the idea of insuring *lives*. The transition from *sea* insurance to *life* insurance was a natural one.

II. If 1000 ships, of the average value of £1000 each, leave a given port within a year, to trade within certain latitudes, and it be found that a contribution of £10 from each (equal to £10,000) has been ascertained,

after long trial, sufficient to pay all the losses by shipwreck which took place within the year, amongst the whole 1000 vessels, it must be evident, that any society, composed of 1000 proprietors, might safely admit any additional single vessel, or number of vessels, bound to trade within the same latitudes, at the same annual contribution of £10, and contract to pay £1000 to the proprietor of each single vessel in case of shipwreck; for the number of admissions, however numerous, would always increase the amount of the contribution fund, or box of premiums, in the precise ratio of the increased *risk* which has been created by the admission of the new members.

III. From what has been stated above, it is natural to suppose that the first system of sea assurance which merchants adopted, was the system of mutual insurance, or clubs. But this was not the case. The proprietor of a single vessel seems to have been satisfied when he was guaranteed a precise sum in case of loss, in return for a fixed premium paid down. The first insurers seem to have been more anxious to have secured to them a determinate and fixed amount of compensation, in case of shipwreck, rather than become speculators in insurance premiums, and have their rate of contribution decreased or augmented according to the result of five or seven years' contingencies. Accordingly, the system of insuring with the members of commercial institutions—

a precise fixed sum in return for a definite amount of premium paid down—soon prevailed all over Europe. In England, for a very long period, sea policies were only granted by the members of the Royal Exchange or Lloyd's. These policies were in the form of a written instrument, obliging the parties to pay a certain sum, should a certain event take place within certain latitudes, and provided no deviation from the course took place, or misrepresentation made as to the age and seaworthiness of the vessel.

IV. In strict *imitation* of sea policies, policies on *lives* became to be demanded on the Royal Exchange and at Lloyd's from the underwriters; and premiums were tendered to insure a person through *part* of the voyage of life—viz., that he would either survive another, or would attain himself *a given age*. Latterly policies were demanded for the *whole voyage of life*, or to pay a given sum when death took place, however distant that period might be from the time the policy was opened.

V. As sea voyages were of limited duration compared with the whole voyage of human life, it became an easy matter, in the first of the above cases, to estimate from observation the risk of sea contingencies, and fix on an adequate scale of contribution to insure against shipwreck, either within the period of a year,

or throughout the duration of a single voyage. But it no less puzzled the mathematicians than it did the merchants of former times, to compute a set of premiums or contributions, applicable to a class of beings all on a voyage highly perilous at every stage of the progress, and where *certain* and *inevitable shipwreck* awaited every individual insured, at some period of the voyage.

VI. The premiums demanded to insure that a life of a given age would survive another of a defined age, or to receive a fixed sum on the death of the party, whenever it should happen, were not originally deduced from any collection of observations. They were fixed at certain sums, generally absurdly high, by mere supposition; and the policies were negotiated at Lloyd's, precisely similar to sea risks, by certain parties underwriting partial sums, on receiving the premiums which appeared, by the mere process of conjecture, adequate to the risk. Accordingly, the premiums demanded in those times were quite overcharged. Eight and ten per cent. was demanded for risks, which might have been adequately covered by four or five per cent., with this further absurdity, that young and old lives were insured at the same charge of premium. In fact, the rates then demanded were more to be viewed as **BETS** that an event would **NOT** happen within the time fixed, rather than the just and adequate price of the risk fairly run by the underwriter.

VII. The system of life insurance—whereby, in consideration either of a principal sum paid at once, or of smaller sums paid annually, the holder of a policy, on the termination of the voyage of life, became entitled to the sum contained in the policy—is of modern invention. The scientific computation of life premiums, which even approximated to correctness, was only given to the world in the early period of the last century, by Simson, De Moivre, Price, and others. This science, though now well understood in Britain, is still in its infancy on the Continent of Europe. It is only in a few of the principal cities of Europe, that life insurance institutions are to be found. In St Petersburg, a fire insurance society is united with the Commercial Bank of that capital ; but the science of life insurance does not appear to be understood or practised in the north of Europe.

VIII. In order that correct premiums may be determined, whereby an office would be rather more than secured when issuing life policies, either for short periods or for the whole voyage of human life, it becomes necessary to possess correct tables of the mortality which takes place amongst a certain number of persons alive at the beginning of a year, and resident within the same climates.

IX. Previous to the commencement of the eighteenth century, no tables of mortality were given to the public

on which reliance could be placed, or from which a true scale of life premiums could be deduced ; but, during the course of that century, a variety of tables were given to the world by Dr Price, Mr Simson, M. De Moivre, and by several continental statistical writers and mathematicians. The observations on human mortality at Northampton, given by Dr Price, were made the basis of life computations during the whole of last century, and the early part of the present one. The observations most in use by the life insurance offices at present established, and who have not abandoned the Northampton observations, are those obtained from returns of the mortality experienced at Carlisle, as given by Mr Milne. Some few offices have deduced their life premiums from a combination of different tables of mortality—such as the Swedish and the government annuitants.

X. Various authors have given explanations of these tables of human mortality, and the mode of finding out the “ expectation of life” at every age therefrom ; but, generally, they have given these explanations and definitions in so mathematical a form, and in language so abstruse, that few ordinary readers have entered on their consideration with much attention, either as a practical science, involving their own pecuniary interests, or as a subject highly interesting to the political economist and general reader of history.

XI. The Highland Society of Scotland caused a table to be computed of the decrement of human life, taking the average mortality of the Northampton, Swedish, and government annuity observations as the basis. From this table it appeared, that, of 1005 persons alive at the beginning of the 21st year of their age, 10 died during that year, and the average number alive throughout that year was 1000; that 915, out of the original 1005, attained their 30th year, in the course of which year ten died; that 681 reached the beginning of their 50th year, in the course of which year 13 died; that only 324, out of the 1005, survived their 71st year; in which year 23 died; and that not one of the original 1005 was alive at the commencement of the 76th year. Thus the voyage of life terminated, by the death of the last person out of the 1005, in 76 years from the 20th year of their ages. The oldest life died aged 96.

XII. Had it been possible to have pointed out the particular life, at 20 years of age, which would have attained 96, it is evident any company or individual might have guaranteed £100, payable at death, on receiving, at the age of 20, such a sum as would accumulate, in 76 years, at compound interest, to £100; or exacted 76 equivalent annual payments. But, as Providence has denied us this knowledge, it is evident that any party interested in the survivance of any parti-

cular life—so as to obtain, for instance, £100 at their death—such party can only be absolutely guaranteed this amount by paying such *an average sum* as is equivalent to the *risk* that any particular life, aged 20, fixed on from amongst 1005, would *not* be the last surviving life, or attain 96, but that he would die during the currency of some of the 76 years, the probability of death increasing with the increase of age.

XIII. The expression “ expectation of life,” is ordinarily defined, “ the time that a person may reasonably have an equal chance, *along with others*, of enjoying life.” The chances against his having longer than the average, are greater than those for it, and, therefore no one ought, when *money transactions are made dependent on the duration of life*, to entertain an expectation of any individual life continuing longer than the average probability, deduced and shewn in the tables formed from the bills of mortality kept in the city or district where such individual is domiciled.

XIV. To illustrate the subject—suppose 56 persons alive, all 30 years of age. M. De Moivre, and other writers of the last century, conjectured that one would die every year, till they were all dead in 56 years. The same would happen to 46 persons aged 40 in 46 years; to 36 persons aged 50 in 36 years; and by an equal ratio for all other ages.

XV. But there is another sense attached to this phrase, which ought to be distinguished from that now mentioned. It has been found by observation that the decrement of human life is not *uniform*, but that it is *accelerated* in the latter stages of life, and *retarded* in the earlier. Therefore the expectation of any single, joint, or surviving lives, may more properly be defined to be “the mean continuance in being, of any life or lives, according to the non-uniform ratio of decrement shewn by any given table of observations.”

XVI. The importance of allowing the doctrine of the non-uniform decrement of life, may be thus illustrated:—Suppose an office were to grant 100 reversionary sums to 100 married persons, all 29 years of age, and to compute the values of such sums on the principle of an equal decrement of life, the office would calculate that, one with another, they would have 19 payments to make for each marriage, and that *all* the payments by the purchaser would *cease after 19 years*, and therefore they would exact such a sum from each, of consideration money, as would, with its interest, enable the office to make 19 consecutive payments to each marriage. But this is evidently erroneous, because many of these reversionary payments would not be made till the end of 20, 30, or 40 years. And it is apparent, that, on account of the greater number of *quick* than *late payments*, when money bears interest, 19 pay-

ments made in the order the deaths *naturally take place*, cannot be worth so much as the same number of payments made regularly at the end of every year, till in 19 years they were all extinguished.

XVII. As the tables of mortality drawn up by all writers exhibit in one column the number alive at all ages from birth to the year wherein the last life is extinguished, the “value of a life,” or “expectation of a life,” is correctly found, by dividing the sum of all the living in the tables of observations at the age whose expectation is required, *and at all greater ages*, by the sum of all that die annually *at that age and above it*; or, which is the same, by the number in the table of the living at that age, and *half unity* subtracted from the quotient, will be the expectation of life required.

XVIII. This deduction of *half unity* is rendered necessary, because it is supposed the members are all *living together* at the beginning of each year; but, during the course of the year, as many will die at all ages as were born at the beginning of the year, above the number alive at the end of the year, equal to the whole number of annual births. The true number alive together is the arithmetical mean between these two numbers; hence the sum of the numbers alive has to be reduced by half the numbers of annual births, the effect

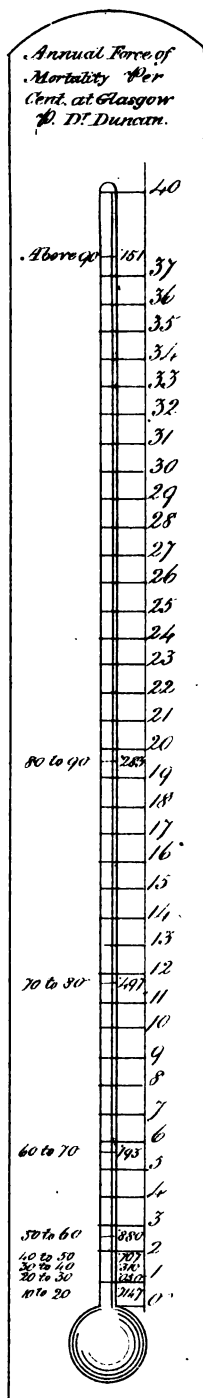
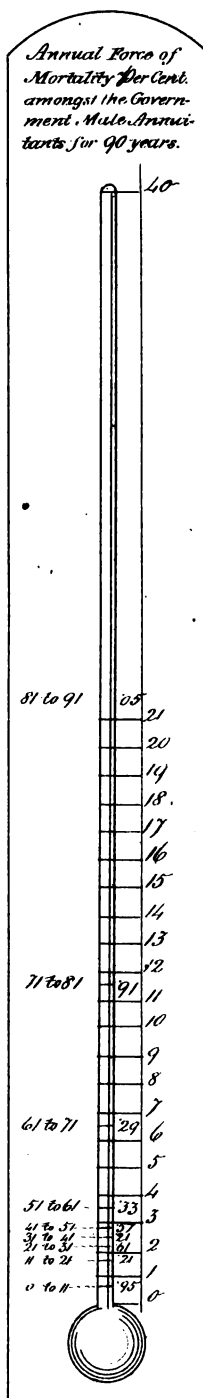
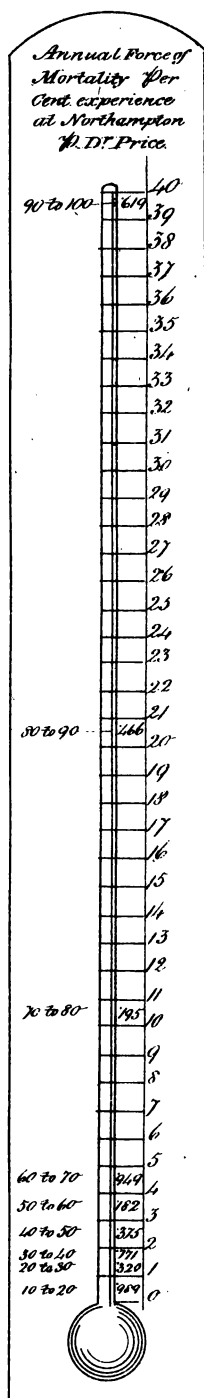
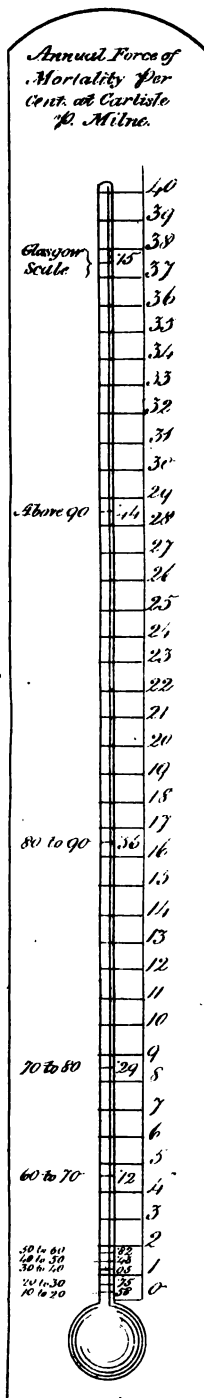
of which diminution is the same with the subtraction above directed.

XIX. The construction of tables of expectation of life being now fully explained, it must be highly interesting to observe how many *out of every 100 alive* die annually at all ages in different countries, and even in the same country at different periods. This comparison will shew what climate is more favourable than another to infant, juvenile, middle, and old-aged existence.

XX. All previous writers on this subject have submitted their results *in a tabular form of figures*, which, in its appearance, presents rather a repulsive aspect to ordinary readers, who do not generally take the *task* of comparing the figures throughout a variety of columns, and through all the different pages of the work. It has occurred to the writer to present these comparisons in the form of a *thermometrical scale or diagram*. If we suppose the fluid in the thermometer to indicate *the force of mortality at all ages*, the scale will represent very clearly the important view of human life in its natural state of a “non-uniform” decrement—viz., that youth *resists* the power of mortality to a much greater degree than *middle or old age*. The following thermometrical tables, and their relation to the value of life interests, may more properly be introduced here than at the end of the work.

The following tables, constructed in a thermometrical form, exhibit, then, the *force of mortality* amongst each *hundred*, at all ages in the tables of observations. The fluid in the tube may be supposed the *destructive principle*—the ages of life the *resisting powers*—the *excess* of comparative resistance indicating the *greater chance of life* at those ages. Taking the Carlisle tables of observations, we find the destructive principle overcomes, between the ages of 60 and 70, 4.12 per cent., whilst between the ages of 70 and 80, the same principle destroys 8.29 per cent.; between 80 and 90, no less than 16.56 per cent. die within the year, whilst above 90, out of every hundred of the population, 28.44 die annually from amongst the population. On comparing the observations made at Carlisle with the other scales placed beside it, we shall find the force of mortality amongst the Government annuitants, as experienced during a period of 90 years, exceeds in degree the force of mortality experienced at Carlisle; whilst, again, the thermometrical scales of the force of mortality, as observed at Northampton and Glasgow, give similar results.

XXI. By the Glasgow observations, as given by Dr Duncan, it is averred that 5.19 per cent. die between 60 and 70, 11.49 per cent. between 70 and 80, 19.28 per cent. between 80 and 90, and 37.15 per cent. above 90; being no less than 9 per cent. at the later



age beyond the Carlisle observations. It is a sufficient demonstration of the inapplicability of Dr Duncan's observations of the Glasgow mortality to life contingencies, when it is known that many life offices have acted on the Carlisle tables for the last 20 years, and have realized large profits, consequent on the result that the actual mortality experienced turned out *less* than the mortality they were led to expect by the Carlisle observations. Besides, it is matter of notoriety, that the decrement of life, as experienced by the Equitable Society of London, which acted on the Northampton data, was only, at all ages, in the proportion of one to two, as compared with the observations. The error Dr Duncan has committed, seems to have arisen from not having made due allowance for the *new settlers in Glasgow within the year*. It would be comparatively of little importance, were the Glasgow observations only matter of curiosity, and were not considered as correct data for estimating the money values of clergymen's stipends, entailed proprietors, life interests, &c. The number alive, by new settlers and passengers, ought possibly to have been increased one-fourth previous to having fixed the ratio of the deaths. It is not too much to affirm, that every clergyman or entailed proprietor selling their life interests by the Glasgow observations, would part with the same for less, by one to two years' purchase, than their true value.

XXII. It is contended, however, by some writers, that no sufficient proof has been, or ever can be adduced, that the Carlisle table of observations is a good measure of the mortality experienced amongst the mass of the English population—that, amongst the higher classes, there is good reason to believe the mortality never was so low as exhibited in that scale—that, with respect to the “experience of the Equitable Office,” life insurers are not a fair sample of the higher classes—that, in every life society, the rate of mortality greatly depends upon its management: a combination of ignorance and carelessness will *augment* the mortality, whilst a system of illiberality and over-prudence will *lessen* it. In support of these statements, the propounders of them detail two very strong, and rather, to life assurance offices and benefit societies, *alarming facts*:—1st, That the rate of mortality amongst British soldiers, stationed *at home*, agrees exactly with the Northampton decrement of life for a population between the ages of 20 and 50. 2d, That the mortality amongst the members of the *English Peerage* does not differ materially from the Northampton observations. These facts, it is asserted, rest upon materials of the most perfect character; whilst the materials used by Mr Milne, Mr Finlaison, and others, are of the *most doubtful description*.

XXIII. To the political economist, the correct

ascertainment of the average duration of human life, leaving money and its interest out of the calculation, is exceedingly important, because it affords a very easy and correct mode of finding out, from the number of births amongst any community, the number of inhabitants in that town or district.

If we suppose a town, the population of which is neither *increased* nor *diminished* in numbers, by recruits from other places, nor by any excess in deaths beyond the births, it is evident that the number dying every year—at *one* year, at *two* years, at *three* years of age and upwards—must be just *equal to the numbers that attain those ages every year* ; or, which is the same thing, to the numbers *alive at those ages*. It follows, on this supposition, that, where there is no increase or decrease, bills of mortality, properly kept, which give the ages at which all die, would shew not only the *exact* number of inhabitants, but also the exact law according to which the decrement of human life takes place in that particular town ; for the number of inhabitants will be just equal to the united numbers on the column of living parties *at all ages*, and the *differences* between the series of numbers which precede and follow one another—when placed in a separate column, entitled the *decrement*—will shew the different rates at which human life wastes, and the *probabilities* of lives of one age outliving those of another age, or attaining a given age, throughout all the different periods of human existence.

XXIV. In articles XVII. and XVIII. has been explained the mode of finding, from tables constructed as above described, the "*expectation*" of a life or lives—that is, the number of years, *taking them one with another*, they may be considered as sure of enjoying. Were the country once possessed of *correct tables*, we might find out the number of inhabitants, supposing the yearly births and burials equal, by simply multiplying the *expectation* of a child just born, by the *number* of yearly births. Thus, in the middle of last century, Dr Halley found the number born in *Breslaw*, annually, was 1238; and that, taking the whole voyage of life in view, and assigning to each child its due *expectation* of life, the duration each child had a right to expect, one with another, was twenty-eight years of existence. Multiplying, therefore, the number born, 1238, by the expectation, 28, gives 34,664, which corresponded nearly with the number of inhabitants in *Breslaw*.

XXV. Though the *expectation* of a child, found by the rule above given, be correct, yet, (see article XVI.) owing to the non-uniform decrement of life, a child just born has not an *equal chance* of living twenty-eight years, with a youth five, six, or seven years of age. Dr Halley found a *child* just born, in *Breslaw*, at the period alluded to, had an *equal chance* of living only sixteen years, though its *expectation of life* was twenty-eight years, by giving to it a *share* of the juve-

nile, middle, and old-aged existence that some of the children just born were sure to possess. The above doctrine establishes the absurdity of those who maintain that the value of a given life *is the same with the value of an annuity certain* for as many years as the life has an *equal chance* of existing. It must be evident, that, though the *average* quantity of life be duly assigned to each, yet, *at* different stages of human life, the *chances* of being first or last in the *order of decease*, are very different. An annuity on a life, which life, in a particular year, might have an equal chance of failing, would be worth *nothing* at the beginning of that year, whilst, if it escaped that danger and attained another age, it would acquire a very different value. Mr Simpson found, during last century, that an infant *just born*, in London, had not an *equal chance* of living *three years*—though its *expectation* was above *twenty-four*. Incredible as it may appear, the chances of the younger person of two lives, from seven to ten years of age, dying *before* the elder, is as 555 is to 444.

XXVI. In all computations deducing the number of inhabitants from the number of the annual births, multiplied by the *expectation* of the life; great care must be taken in allowing a modified expectation of life to the number of burials which exceed the christenings—an excess always the case if the town is annually

receiving an addition to its population by *new settlers*. Dr Price supposed the new settlers fixing themselves in London, to be, *on an average*, eighteen to twenty years of age, and their expectation of life thirty years; and, as, on a medium of ten years, he found the burials to exceed the births by 7,246, he added the product of these two sums $7,246 \times 30 = 217,380$, to make up the probable number of inhabitants in London.

In every city where the population is *increasing*, an influx of strangers must take place, else the population would decrease in the ratio the burials exceed the births; and, therefore, to find the true number of inhabitants, the excess in the burials beyond the births, falls to be multiplied by the expectation of life, and added to the former number found. From not possessing correct registers of the births and burials in this country, we are deprived of making one of the most beautiful discoveries in economical science, for determining the number of inhabitants in the parishes and cities of the kingdom, and have to trust for returns of the population to the correctness of parties who undertake the duties of an office they are by no means qualified to discharge; whilst the lower and middle orders *conceal* the numbers of their families, under the impression that some future poll tax, or militia register, is intended by the Government, when making a national enumeration of the people.

XXVII. For the reason above given, every political

economist must hail with satisfaction the measures proposed for Scotland, and already given to England, by his Majesty's Ministers, for establishing complete records of the marriages, births, and deaths amongst the entire population. If the *ages* at which the deaths take place be correctly given, so as the *ages* of those alive can be deduced therefrom, the registers will be the most important records ever given to economical and political science. The most splendid opportunity this country ever possessed for obtaining the valuable information of the *ages of the living*, was thrown away by the Government of 1831, when engaged in the national census. They strangely neglected to take up the *ages* of the inhabitants, as was done in 1821; and thus science was deprived of the most valuable primary element necessary to its calculations.

As Scotland possesses a *central point*, at her General Register House for all Scotland, it is to be hoped provision will be made in the Scotch Bill, that copies of the different parish registers kept throughout the kingdom will be annually forwarded to Edinburgh, for the purpose of preservation, and of being made serviceable as data to prepare the annual results for the whole kingdom.

CHAPTER II.

PROGRESS OF THE SCIENCE, BY THE EXTENSION OF THE
INQUIRY INTO THE DECREMENT OF LIFE WHICH
TAKES PLACE AMONGST THE MILITARY AT HOME AND
ON FOREIGN STATIONS.

XXVIII. THE decrement of life, as experienced at all stations of the British army, both at home and abroad, has been lately given to the public in that valuable work, the *United Service Journal*. In consequence of these investigations, a new science may be said to have been discovered—namely, the science of *Military Economy*. Governments who keep up Colonial possessions and standing armies, would do well to introduce a knowledge of this science into those departments the ministers of which are charged with the regulation and disposition of the military force.

On looking at the decrement of life which takes place invariably on certain islands, continents, and Peninsulas, it appears that human life is destroyed in a compound ratio, made up of the degree of salubrity or reverse of the place of residence, joined to the *time* the

life is subjected to the fixed mortality of that station, and to the means the life possesses to avoid non-exposure to the climate, at the hours of the day most injurious to life.

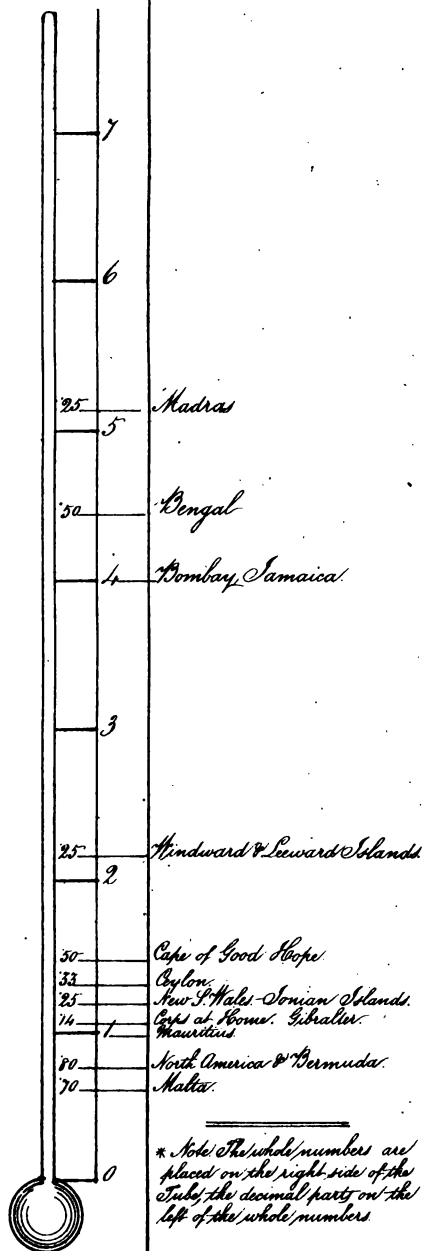
The decrement of life, at some stations, even amongst the officers, is so alarming that no life insurance office could, with safety, secure to the wife, sister, or child of any officer, stationed within the range of the West India mortality, the succession to any estate or contingent reversionary right, unless at a per centage of premium which might well be deemed exorbitant; whilst, in the case of a private soldier, though he were heir to an entailed estate, or were a benevolent individual anxious to secure his *right of pension* to him, his life would be found to be beyond the pale of life insurance altogether.

From the most profound ignorance on this subject must be attributed the astounding fact that officers in the army actually pay down a sum for their regimental commissions, far beyond the sum required to purchase an annuity equal, in amount, to the pay attached to said commission. Thus, officers actually give their *risk* of life, *time*, expense of clothing, and contribution to mess, &c., for the *privilege of serving their country*!

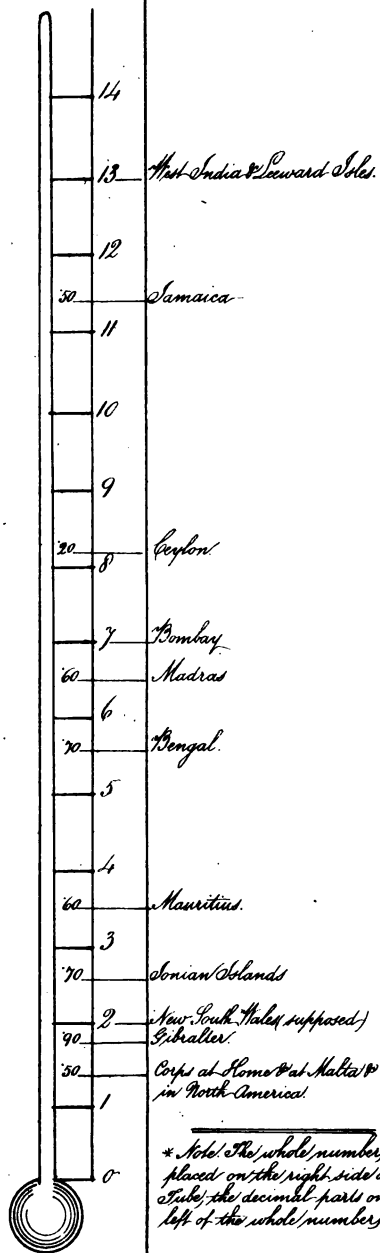
XXIX. There is here given, in a thermometrical form of a scale, the comparative mortality, per cent., of

the British army, at all stations, for 10 years—from 1826 to 1835; the mortality, amongst the *officers*, distinguished from the mortality experienced amongst the *privates*. The scale of *risk* here given, will serve as data to fix what amount of *extra* premium ought to be demanded by a life office, for the transference of an assurance on the life of an officer, removed from this country to one or other of the *extra risk* military stations. The comparative decrement of life between *officers* and *privates* on foreign stations, so far exceeds in difference what would naturally have been conjectured, that, were the results not verified by returns to the War Office accessible to the public, the result would be perfectly incredible. The East India mortality ranges, *for privates*, between 5 and 7 per cent.; the West Indian mortality ranges between 11 and 13 per cent., whilst, *at home*, the mortality amongst the *privates* does not exceed *one and a-half* per cent. The effect of this discovery will, no doubt, lead as one of the results of military economy being introduced as a science, that a soldier, who has served in the West Indies a term of years, computed in the ratio of the *extra* mortality, will, so much *sooner*, in the same ratio, be entitled to enjoy his retiring pension. Were this not to be conceded, *privates* who have served *ten* or *twelve* years in the army at home, and who have acquired thereby a valuable *reversionary pension interest*, are *defrauded* of it by being subjected to a West

Mortality per Cent.
experienced amongst
the Officers of the Brit-
ish Army at all stations
from 1826 to 1835.



Mortality per Cent.
experienced amongst
the Private Soldiers of
the British Army at all
stations, from 1826 to
1835.



Indian and Leeward Island mortality, without compensation or *chance* of obtaining a superior pension to those serving at home, who may attain 20 or 25 years of service.

XXX. We have exhibited, in two thermometrical scales, the comparative force of mortality sustained by the foreign British army, as it is proved to have taken place by the returns to the War-Office, distinguishing the mortality which has been sustained amongst each 100 *officers* from the mortality experienced amongst each 100 *privates*. On a comparison between these two scales, the immense difference in the comparative force of mortality will at once be apparent. To the relatives of the *privates* the result is distressing; and the country has the burden of *comparative injustice* to the private soldier to add to its other obligations. The general result per cent. of comparative mortality to the *private force* of the British army, between home and foreign service, will be seen by referring to the thermometrical tables. The effect of this mortality on the finances of the country, or rather on the selection by the country of its own creditors, may thus be shewn:—Out of 1000 men subjected to 21 years' exposure to East and West India mortality, and to only four years of home service, (the hitherto general average of service,) 136 would only remain alive, at the end of these 25 years, to claim any pension from the

country, whilst, amongst the *Guards* and other favoured regiments *kept at home*, no less a number than 691, out of the original 1000, would survive to become annuitants for life on the public purse. To *reduce* this immense force of mortality so far as it is made to affect a *limited number* of the British army, and to spread it *equally* over the whole army, seems but an act of pure justice to the soldier, viewed either as a human being, or as a contingent creditor of the state. In ordinary circumstances and by *fair* treatment, he ought to have a fair chance of receiving the value of his claim to a reversionary annuity for life, after 25 years' service, which, by the ordinary *distribution* of the British army, is worth *less than nothing* to the West India soldier.

XXXI. This act of *pure justice* to the soldier, writers, competent to speak authoritatively on such a subject, say might be rendered equitable by the adoption of some plan of distributing the army, founded on principles analogous to the following :—That, instead of regiments, as at present, being made to undergo *four* years of banishment to New South Wales, as a *preparative* for *fourteen years* of further banishment to the East Indies, each regiment should, *in rotation*, enjoy *three* years of Cape and St Helena service, *four* years in the Mauritius or Ceylon, and another *three* years at the Cape or St Helena, *on their way home*, making in all *ten* years of active foreign service.

The regiments destined to endure *West* India service, ought to be sent to our stations in the Mediterranean, in the first instance, for *four* years; next, to the West Indies for *three* years; and then to America for *three* years—making in all an equal period of *ten* years' service. With regard to East India service, it is contended, that service is too important and the climate too *various* and dangerous, to be made one of *routine*; that the East India regiments should be sent out *direct*, for a period of *ten* years only, and then be sent home. Thus there would be *three* tours of foreign service established; the two first embracing a *fair proportion* of the healthy and unhealthy stations, the last reducing the term of service in the East Indies as low as our engagements with the East India Company may possibly permit,

XXXII. It has been represented, in favour of this proposed mode of distributing the foreign army of the British empire, that, in the first place, the West India soldier would be cheered by the prospect that his extra *chance* of losing his future pension would terminate in three years; and that he would, probably, regain his native shores with an unimpaired constitution. The East India soldier would, in all probability, *resist* the present tendency to despair of ever either enjoying his retired pension, or revisiting his native country. The influence of this hope would prove his best safeguard, both against the inroads of *disease* and *dissipa-*

tion—for which results the Government, owing to the present mode of distributing the army, is fully as much to blame as the individual soldier. With the *morale* of these questions the author disavows any right to express an opinion against the Government; but, as a calculator of life contingencies, he is bound to bring prominently forward the gross comparative injustice done to the soldier sent to foreign stations, when compared with the privates or officers of the Guards, constantly kept on home service, and yet entitled to the *same amount* of retiring pensions. A mortality of $1\frac{1}{2}$ per cent. on the latter service, ought not to entitle to the same amount of pension with a service exposed to an average mortality of *twelve* per cent. *Ten* or *fifteen* years of foreign service, ought to entitle the soldier to the same amount of pension with the Guards and soldiers kept exclusively on the *home* stations for 25 years.

XXXIII. The value of a retired pension to the soldier, has been supposed equal to the value of an annuity for life, shewn by the Carlisle tables at the corresponding ages. As Government possesses the means of solving this problem, and as its solution would guide all future Ministers of the Crown in advising the sale of the *dead weight*, as the pension list has been called, it is to be hoped the Government will give access to the military records at the Horse Guards, so as the following *neces-*

sary data may be obtained. 1. The proportion of recruits, raised annually since the peace, who have died, deserted, or been discharged, with or without pension, specifying the ages and periods of service at which they became non-effective. 2. What proportion of soldiers of each age die annually; for instance, how many per cent. of those died between 20 and 21 up to 45 years of age at least, which age it is supposed exceeds the *average age* at which all soldiers are admitted on the pension list. 3. What was the age of each individual on the Chelsea pension list in 1816; also the age and period of service at which every one has subsequently been pensioned, and the decrements annually by death, with the age of the parties so deceasing; and, if any have commuted the pension, the age at which such commutation has taken place.

XXXIV. For want of the above data, the retired military mortality of the kingdom is left to conjecture, though information exists which enables us to approximate to the true present value of all the pensions payable to those on the Chelsea pension list.

It appears there were on the out-pension list, on the		
1st January 1823,	.	81,189
That there were admitted during the five		
following years,	.	17,486
<hr/>		
Making,		98,675

	Brought over,	98,675
On the 31st December 1827, the numbers		
on the pension list were,		55,515

Shewing thus a decrease, in five years, of 13,160
equal to an *annual* decrease of 2,632.

This annual decrease upon a number averaging from 81,189 to 85,515, shews a mortality of only $3\frac{1}{2}$ per cent. took place, and makes the expectation of life to those on the pension list, on an average, nearly 32 years. It appears, by the Carlisle tables of mortality, that, of 168,898, alive, *at all ages above 34*, the average number of annual deaths was 5,362, or rather more than $3\frac{1}{2}$ per cent. Therefore, it follows, that the value of a soldier's pension, is equal to the value of an annuity, as shewn by the Carlisle tables; and does not correspond with the more recent values of annuities, as given by Dr Duncan of Glasgow, computed from the mortality of that city. As we know that very few are admitted on the pension list at so early an age as 34, were Dr Duncan's tables of mortality correct, the decrements by death amongst the soldiers on the pension list are not so numerous as among persons who have never been in the service.

XXXV. If the question as to the *true* value of the pension of a private soldier, at any particular age, and after some particular course of service, be one of diffi-

cult solution, the present value of an officer's full or half-pay, is placed still farther from our reach, for want of information from Government. The mortality amongst 711 officers of the household troops for nine years, from 1826 to 1835, has been only $5\frac{1}{2}$ annually, or .828 per cent.; whilst, during the same period, the mortality amongst the officers of *all* the regiments in the United Kingdom, was at the rate of $1\frac{1}{2}$ per cent, or nearly double the mortality experienced amongst the household officers, shewing there must have been some *fatiguing* service endured by officers quartered in Ireland, and in the manufacturing districts, not experienced by the officers of the household troops stationed in London. By observations embracing a period of nine years, and extended over 3752 officers, it appears, the *exact ratio* of mortality was 1,949, or within a fraction of two per cent. for all officers of the British line, collectively. Subdividing this mortality into *regimental rank*, it appears—

31 Colonels died, giving a proportional mortality	
of	2.8
206 Majors,	1.833
1040 Captains,	2.35
99 Ensigns,	1.125

As the majors, on the average, must have been **younger** lives than either the captains or ensigns, probably some regimental duty, such as evening guard, assigned to the captains, increases the mortality.

XXXVI. The East India mortality amongst the officers indicates that the risk of life differs considerably at different stations, and that it would be unwise for any life insurance company to adopt one general rate of extra premium for all India. The aggregate mortality for *all India*, amongst the officers, was about $4\frac{1}{2}$ per cent., whilst, separated into a *station* mortality, it was found to be

At Madras,	5.27 per cent.
Bengal,	4.68 per cent.
Bombay,	3. per cent.

It is very singular that a distinction, in the rate of mortality, obtained even between the cavalry and infantry. Amongst 130 officers of cavalry, 31 died in nine years, giving a general rate of 3.44 per annum, being less by 1.31 per cent. than the general average of *all* officers. These cavalry officers, classified again as to *station*, were

At Madras,	3.413
Bengal,	2.129
Bombay,	1.794

Thus, the mortality amongst the cavalry officers at Madras, is nearly *double* that which takes place at Bombay. It follows, the value of a cavalry commission at Madras and Bombay, as well as of the chance of enjoying the reversionary retirement pay, are of two very different values, according to the presidencies at which the officers are to be stationed. At Ceylon,

during a period of nine years, there took place only 15 deaths, from amongst 84 officers, being only equal to a mortality of $1\frac{1}{3}$ per cent. In the Mauritius, for a period of nine years, the mortality amongst 70 officers was *less* than 1 per cent. This mortality is less than that experienced in the United Kingdom, and can only be accounted for by its possessing a temperature not exceeding that of the south of France.

XXXVII. The separation into *station* mortality of the *general* West India mortality, also indicates a remarkable difference. In Jamaica, during a period of nine years, a mortality took place amongst 70 officers, equal to 4 per cent., whilst, in the Windward and Leeward Islands, amongst 175 officers, the mortality was only $2\frac{1}{4}$ per cent. The officers stationed in North America, and in the Bermudas, experienced a mortality considerably *less* than the mortality of the United Kingdom. Throughout the Mediterranean stations, Gibraltar indicates the highest mortality, being $1\frac{1}{2}$ per cent., whilst the Ionian Islands only gave $1\frac{1}{4}$ per cent., and the mortality at Malta was so low as .90.

Amongst the African corps, the average deaths, for nine years, amongst 27 officers, was 2.89 annually; and making allowance for $\frac{1}{3}$ of the officers, supposed to be at home, this mortality was equal to a decrement of 13 per cent.

XXXVIII. The important gain to the science of life assurance afforded by the above information, must be apparent. Some *data* now exist to guide an office in *approximating* to the true risk they run, by granting life policies to civilians or officers on foreign stations. It would appear, however, from a statement given in the *Madras Courier* of October 1816, that lives in the civil and mercantile service of India, gave a greater mortality than was experienced in the military life during peace. Out of 1366 European gentlemen, exposed to the climate of India, from 1813 to 1816, a period of only three years, there died—

Having resided under 12 years, about 4½ per cent.	Resided from 12 to 18 years, about 3½ per cent.	Resided 18 years and upwards, about 2½ per cent.
---------------------------------------------------------	-------------------------------------------------------	--------------------------------------------------------

A mortality amongst the *first* class, in *three* years, nearly equal to what took place amongst the military during nine years.

No life office ought, perhaps, to take too many risks *at one station* at one and the same time. By spreading their risks over all stations, the excess of salubrity at one may make up the loss occasioned by some temporary visitation of disease at another particular station. In Jamaica, in 1819, some disease, worse than the cholera, produced an extraordinary mortality in the 92d regiment.

Of 27 officers, 10 died = 37 per cent. in 6 months.

5 ladies,	4	„	= 80	„	„
650 men,	280	„	= 43	„	„
60 wives,	29	„	= 45	„	„
70 children,	38	„	= 54	„	„

But that such an extraordinary visitation of disease should not be allowed to regulate the premiums for the insurance on lives, will at once be manifest, for, *during the following eight years, the mortality was under four per cent.*

By not extending the range of observation on human life to considerable periods of time, a mortality, such as the above, taking place, *once* even in a century, might exclude officers and civilians, resident in Jamaica, from the benefits of life insurance altogether.

XXXIX. Life insurance establishments need not, in fact, be seized with a *panic*, even though war were to visit our shores. It is stated, that, from January 1811 to May 1814, the average strength of the Peninsular army, as ascertained from the monthly musters, was 61,511 privates, and 2716 officers, whereof there died, in the course of the above period, 33,819 privates and 940 officers. Taking the number who were actually killed in battle, or who died within one month of their wounds, it appears that the decrement of life, amongst the officers, was only $5\frac{1}{2}$ per cent. from battle, and 5 per cent from fatigue, equal to a mortality of *ten*

and a half per cent. from all causes. Subdividing these officers into the three great army classes of cavalry, infantry, and artillery, the following curious result is obtained:—Out of 1000 officers, actually engaged in the field of battle, there were killed—

Of cavalry officers,	. 37
Infantry officers,	. 33
Artillery officers,	. 11

It follows, a policy on the life of an artillery officer, on going into battle, payable should he be a survivor, might be granted at *one-third* the premium which ought to be exacted from a cavalry officer.

XL. It has been proved by the military returns from North America, as exhibited in the thermometrical scales given in this work, that human life is not subject to a greater decrement than it is in this country throughout all parts of America north of the fortieth parallel of latitude. It follows, that policies on the lives of agriculturists and merchants, resident on that continent within these parallels, ought to be granted on the same scale of premiums with that applied to parties resident in Great Britain. This discovery of the true decrement of life in North America, is solely owing to the records at the war office, which exhibit the military mortality. The importance and value of the discovery can only be estimated by considering the great number of parties who have already proceeded to America, and

who have reversionary property in this country, or enjoying *life-incomes* in their newly adopted one, of which they wish to *secure* the possession, until they have accumulated a fund to support their widows and families.

XLI. Many parties who have emigrated to our North American colonies, are obliged to leave behind them valuable leasehold interests. This is particularly the case with Irishmen. In that country, lands, mills, fishings, and other leasehold interests, are often let to a tenant for one, two, or three lives. Land is by the tenant improved, buildings added to mills, and various outlays take place. The tenant afterwards is induced to emigrate; and the value of his improved lease is the *fund*, in many cases, which is to serve as capital in America. In the most numerous class of leases, they are made to endure on the life of the tenant himself, and very frequently afterwards on that of his son. When the tenant, *along with his son*, determines to sell his lease, it is evident that, unless the proposed purchaser can get the life or lives in the lease insured at a fair premium, the purchase price must be diminished in the ratio to the risk of the lives failing within a short period. The market price of a life-tenant lease in Ireland, where the life-tenant emigrates to Canada, or to Jamaica, must evidently be of a different amount to the purchaser, in the ratio of the premiums demanded to insure a life, in a healthy or unhealthy station.

XLII. The scale of life premiums which are proved to be applicable to North America will, very probably, be found also applicable to Australasia and Van Dieman's Land. These countries recede from the equator, 30 or 40 degrees south, being about an equal distance to that *where the healthy climate north of the equator commences*; and, probably, the *force of mortality* will be found, throughout Australasia, to be in the same ratio experienced in this country, and throughout the continent of North America. This supposition is strongly borne out by the evidence of the Rev. Dr Lang, Principal of the Australasian College, as given in his "Historical and Statistical Account of New South Wales." At page 192, the Doctor states—"Either the Royal College of Physicians, or one of the other medical boards of London, transmitted a series of questions, a few years ago, to certain medical gentlemen in the colony, to ascertain the *average duration of human life in New South Wales*. It is scarcely possible, however, to arrive at accurate conclusions on such a subject for many years to come. There cannot be any native of the colony (the phrase uniformly designates a native of European descent) at this moment more than forty years of age; and, in regard to those who have arrived as adults, whether free emigrants or convicts, there has, hitherto, been so many disturbing circumstances, arising chiefly from the character of the population, to counteract the natural salubrity of the climate, that the present colonial bills

of mortality would, undoubtedly, lead the man of figures and calculations to most fallacious conclusions. For my own part, I am inclined to believe that the probabilities of life, for any number of children born in the colony, are *higher* than for a similar number born in England; but that *fewer* of that number are likely to reach extreme old age in the colony than in Great Britain. In short, the lamp of life in the salubrious climate of New South Wales, is like a taper immersed in a vessel filled with oxygen gas—it burns more brightly than in common air, but is sooner extinguished.” The correctness of the Doctor’s conjectures are abundantly verified by the *military mortality* in New South Wales. Notwithstanding the occasional harassing night guard of the officers, in a country where *criminals* have to be incessantly watched, yet the mortality, as will be seen by referring to the thermometrical scale, does not exceed the mortality which takes place amongst the troops stationed at home.

CHAPTER III.

PROGRESS OF THE SCIENCE SINCE 1825, ARISING FROM
THE INTRODUCTION OF ASCENDING SCALES OF LIFE
PREMIUMS.

XLIII. FROM the first dawning of the science of life insurance, to the year 1825, it was not supposed possible to devise a plan whereby insurers might have the advantage of opening a life policy on behalf of their relatives, unless they were to pay, in advance, a sum, *by equal annual payments*, sufficient to cover an *average* uniform risk for the whole voyage of life. In fact, the *non-uniform* decrement of human life, though always admitted to exist, was not by life insurance offices brought into practical bearing, so as to regulate the mode of exacting life premiums, *safely* for the office, whilst accommodation in paying the premiums was given to the policy holders. The individual insuring was not supposed capable of being made banker to the company for the amount he might *safely be intrusted with*.

In articles 16, 24, and 25, it has been shewn that human life does not decrease by a ratio uniform in amount; but the decrement is *retarded* by *youth*, and *accelerated* by old age. It must be, therefore, apparent, that any life office would be quite *safe*, though they undertook risks, simply exacting during the early years of life such a rate of premium as corresponded to the *annual risk*, added to the expenses of management—still more would a life office be safe in exacting, for the first year, a premium equal to the *average risk* of the first *five, seven, or ten* years.

XLIV. By referring to the diagram which represents the estimated *risk* to an office, *during the whole voyage of human life*, it will be seen that a scale of life premiums may be inserted, for the *first* fifteen or twenty years of life, *above* the line of annual risk, and yet *far below* the scale of uniform premiums demanded by any existing life office for a policy to be in force during the whole life of the party; and office premiums to be exacted, by a *uniform rate*, to cover the risk for the whole of life.

The proof, by means of the diagram, of the *safety* of the ascending scales of life premiums, was submitted, by the author, in 1826, to Mr Parry, of the Hope Life Office, the able coadjutor of Mr Davies of the Guardian, in completing the celebrated tables of life

contingencies, which were published in 1825, and now out of print.

XLV. It will require very little of detail to shew that the adoption of the *ascending scale of life premiums* was an improvement. The *safety* of the mode to the office, as remarked in last article, may be made apparent to the eye, by drawing lines of *safety risks*, for periods of 5, 10, or 15 years, *between* the lives representing the annual *risk* for the whole voyage, as has been *experienced* at the Equitable Life Office of London, and the line corresponding to the premiums *actually exacted* by the Equitable Office; which *excess* of premium, it may be remarked, alone enables the office to make those returns of profits called *bonuses*. The advantages to the insured from this mode of exacting life premiums, must be abundantly obvious. A young man, for instance, in a public office, who has a *graduated* scale of salary, rising, *by periods of years*, from £50 or £100, to £200 or £300, is, by the *ascending plan*, enabled to open a life policy for behoof of his family, to an extent perhaps of £2000, by *graduated scales of premiums*, rising in amount in a ratio corresponding with the rise in the amount of his salary. Again, a party possessed of a contingent reversionary right, that is payable should he survive another, and generally of an *older* age—such a party may open, *instead of a survivorship policy*, a policy for

the *whole endurance of life*, by the ascending scales of premium, and still have not to advance, during the probable duration of the older life, a sum greater in amount than the survivorship scale of premiums ; whilst, at the termination of the older life, he will find himself in possession of a valuable policy, which he may either surrender to the office or continue for life, in place of possessing a policy which, on the *instant* of the death of the other life, is worth nothing. A party whose income is a *certain* and *improving* one, may borrow upon a redeemable annuity, and convert the sum borrowed into increasing annuities for terms of years; whilst the creditor, from the very outset, may cover his whole advance by life insurance out of the first and smallest rate of annuities, owing to the facility the ascending scale affords. In these and various other cases which could easily be supposed, may the improvements in the science of life insurance, made within the last twenty years, be well considered as invaluable acquisitions to the country—to all holding improving life situations, entailed proprietors of young ages, and others.

XLVI. The applicability of the *ascending* scale of life premiums to entailed proprietors in expectancy of *young ages*, will, perhaps, be best illustrated by an example. The Supreme Court of Scotland interposed their authority, in November 1836, to a factor *loco tutoris* purchasing an annuity to his ward, until she

should succeed to certain entailed estates by the death of her grandfather. The survivance of the child beyond the grandfather was the *only contingency*. The life of the young ward could therefore be insured on the *ascending scale*, on terms which would, whilst affording absolute safety to the *purchasers of the reversion*, allow the tutor to set aside, out of the annuity authorized by the Court, a much larger annual sum than if he were to pay an equal premium for the whole of life. In the case here alluded to, the purchasers of the annuity advanced the life *premiums*, and took an equivalent reversion in payment. But this does not affect the principle of the applicability of the ascendancy scale to such cases as an heir in expectation to an older life, anxious to possess a policy for the whole endurance of life, payable by *increasing rates*, rather than a mere *survivance* policy. In fact, were the life to meet with a *serious accident*, even immediately on the succession opening, no possibility would exist of borrowing money on the life interest, to pay claims *due on coming into possession*, or securing reversionary annuitants, unless temporary life policies, convertible into policies for the *whole of life*, were accessible to the entailed proprietor.

CHAPTER IV.

ON THE PRINCIPLES ADOPTED IN COMPUTING THE *present value* OF POLICIES ON LIVES, PROPOSED TO BE SURRENDERED TO THE INSURANCE COMPANY WHO ORIGINALLY ISSUED THE POLICY.

XLVII. THAT no uniform fixed rule or principle, for the valuation of life policies by *all* insurance companies, *as a body*, has hitherto been adopted, is much to be regretted. The want of a *principle* of computation has been noticed and been made subject of complaint, both by Mr Bailly and Mr Davies, the highest authorities on the subject of life contingencies. It is difficult to say what rule is adopted by any office, in the valuation of their policies, when this value is to form the *amount* to be returned to the party who proposes to surrender a policy. We know, however, this important element in the calculation—namely, the value each policy is held to have acquired *on the assets of the company*, when it becomes necessary *to value the outstanding risks against the office*, at the periodical valuations. At the

period of the quinquennial or septennial division of profits, as the case may be, the value of each policy is completed in the manner hereafter to be shewn. A *reserve* equal to this value is then made for each policy, and an estimation of the amount of the *future* premiums to be received thereon, together, constitute an equivalent to the increased premiums, by a single payment, which would be demanded to insure a life of the *then age*, with the policy-holder. The case may be illustrated in another manner, and by a practical example. Suppose a party now aged 50 opened a policy thirty years ago, when he was 20, for £1000, and went to the office, making a surrender or sale of his policy to the company for a *fair value*. On purely mathematical and apparently fair principles, the company ought to compute the value of the policy, by counting the office as indebted to the assured in the *present value* of an assurance on a life of 50, and the *assured* indebted to the life office the present value of all the payments during the remainder of his life; and, consequently, the interest of the assured in his policy ought to be equal to the *difference* between these values. This valuation may be further illustrated. A party aged 20 when his policy was opened, would have then paid for £1000, in annual premiums, £21 : 15 : 10. The value of an annuity by the Northampton tables at three per cent., of £21 : 15 : 10, to a life aged 50, is 13.436 years' purchase, giving, by multiplica-

tion, £292 : 15 : 7, as the present value of the annual payments which the office has a right to expect to receive from the assured. The office, on the other hand, is indebted to the assured in the *present value* of £1000 on a life aged 50, which is, by referring to any life tables computed on the three per cent. Northampton data, equal to £608 : 13 : 2. Therefore the *difference* between these two sums of £608 : 13 : 2, and £292 : 15 : 7, being £315 : 17 : 7, is the mathematical, true, and real value of the policy—being a sum exceeding the amount for which another office would accept the risk.

XLVIII. It is well known, however, that the scale of life premiums, deduced from the Northampton scale of tables of mortality, are far too high—in fact, that scale of mortality is only *assumed*, not *experienced* by the office, and hence the *difference* between the decrements of life, as *supposed* and *experienced*, added to the rate of interest gained by the company on its investments, beyond the rate of three per cent. *assumed*, enables those offices, whose premiums are computed on the Northampton data, to add *large reversionary sums* to the different subsisting policies, usually denominated *bonuses*. If, therefore, a party has had the nominal sum in his policy increased by a bonus, we must add the present value of an assurance of the additional sum or *bonus* to the former value found, to bring out the

true amount the party surrendering his policy is entitled to expect. Thus, in the above case, had bonuses to the amount of £500 been declared *vested* and belonging to the £1000 policy, without any annual premium corresponding to the additional £500, it is clear the assured is possessed and entitled to the *present* value of the £500, or £304 : 6 : 6, in addition to the above sum of £315 : 17 : 7.

XLIX. A thermometrical scale of the mathematical values of all policies, opened with an office whose premiums are computed by the Northampton three per cent. tables, is herewith given. The values for periods from five to twenty-five years of endurance, are exhibited thus :—The whole number on the right side of the tube shew the *per centage of value each £100 has acquired*, which was insured in the policy, and this at the various periods of 5, 7, 10, 14, 15, 20, 21, and 25 years from the opening of the policy. Thus a party aged 33, who *then* opened a policy for £1000, were he to surrender it at the age of 38, ought to receive 6.29 per cent. or £62 : 18s., as the consideration for surrendering the interest he holds in the policy. Were any *bonus* declared to vest in such policy, the *present value* of the reversionary sum or *bonus*, would fall to be added to the above sum of £62 : 18s. Those offices, therefore, who declare their bonuses quinquennially, are evidently more favourable to the public, than the offices

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who allocate their profits at more distant intervals. Indeed, no good reason can be assigned why *triennial* or *annual* additions should not be made to all policies.

CHAPTER V.

ON THE PRINCIPLES ADOPTED BY LIFE OFFICES, WHO
GIVE PARTICIPATION OF PROFITS TO THE ASSURED, IN
BALANCING THE BOOKS OF THE ASSOCIATION, AND
IN FIXING THE AMOUNT OF THE BONUS WHICH FAIRLY
BELONGS TO EACH CLASS OF THE INSURED.

L. THE illustrations given in the last article (XLIX.) will sufficiently explain the mode by which the interests of the assured in their various policies are ascertained. The affairs, therefore, of any mutual life assurance company, at the period of their septennial balance, must stand thus:—The company possess assets of various descriptions, equal to the amount of their accumulated capital, arising from premiums, forfeitures, fines, &c., which may be called the *credit side* of the account. The office, again, stands indebted to the policy-holders, in sums equal to the *present value* of the sums named in the policies; and further indebted in sums equal to the present value of the bonuses, or

reversions, which have from time to time been added to the original sums in the policies. The united amount of these two classes of debts, being deducted from the amount of capital in hand, must leave the net *new fund* of profits, realized since the former allocation of profits, and which new fund falls to be divided amongst the assured.

LI. Let us now suppose that the assurance company is a new office, and that they are, for the first time, to allocate the fund of profits to the various policies, the question naturally arises, How ought these profits to be distributed? Ought the policy-holders, as partners, to be viewed as *partners* and *sharers* in the *realized capital stock* or funds of the company?—or ought their interests to be measured by the *amount of the outstanding reversionary claim* each policy-holder has, separately, against the company? By adopting the *realized capital stock* as the element of appropriation, we act at once on this equitable principle, that the divisible profit is thereby appropriated among the policy-holders, *in direct proportion to the shares which they have contributed to that profit*. It is essential, however, to this principle to admit, as an element in the ascertainment of profit, that effect be given as far as possible to the changes in the decrements of life at the various ages. This is effected by valuing each policy separately, as illustrated in article XLVII.; or the value may

be found by adding the amount of the accumulated premiums received under the policy to the sum of the values of the future premiums to be expected ; and from this amount deducting the sum another office would accept to transfer the liability. The *sums* of profits thus found to arise from *each policy* are then held as the measure of the shares which *belong to each* of this divisible profit ; or, in plainer terms, the gross fund of *free profits* is allocated to each policy, *in the proportions which the calculated profits on the whole bear to the calculated profit on each.*

LII. This mode of ascertaining and allocating the profits has been adopted by the Atlas, Guardian, Sun, Life, and other offices in England, and by the Edinburgh Life Insurance Company in Scotland. The effect of this mode of *ascertaining*, and, 2dly, *dividing*, the profits of a life assurance company, may be thus illustrated :—

Seven-Years Old Policies for £1000 each.		
Ages and Premiums.	Additions to Policies.	Calculated Profits.
A 20, pays £2: 3: 7 annually .	£26.575	£112.377
B 40, pays £8: 7: 11 do. .	30.232	164.347
C 55, pays £5: 12: 9 do. .	43.193	282.484
Equal to a realized profit of £100, of £100.		

On the plan that the division of profits ought to be regulated, not according to the shares of the members *in the realized funds or capital of the company*, but in the ratio of their shares in the outstanding claims against these funds, the following very different result, at the end of the seventh year, would take place.

Seven-Years Old Policies for £1000 each.		
Ages and Premiums.	Premiums paid accumulated at three per cent.	Bonuses.
A, aged 20. Premium, £2: 3: 7 per cent., - - -	£171 19 9	£33 6 8
B, aged 40. Premium, £3: 7: 11 per cent., - - -	268 0 2	33 6 8
C, aged 55. Premium, £5: 12: 9 per cent., - - -	444 18 7	33 6 8
Equal to a realized profit on the three policies of . . .		£100 0 0

From the above, it will be seen the result of the two modes of division contended for is:—By the first mode C, aged 55, would receive a present benefit of £43 : 19 : 3, instead of by the latter the uniform sum of £33 : 6 : 8 ; and the effect on the reversionary sums would be still more dissimilar.

LIII. By continuing the investigation and allocation of profits, on the first plan, to a period of 21 years, on

a policy of £1000, at the three ages above mentioned, we will find the following surprising results :—

A, 20, paying a premium of £2 : 3 : 7, will have calculated profits of . . .	£439.091
B, 40, paying a premium of £3 : 7 : 11, will have profits set aside . . .	665.619
C, 55, paying a premium of £5 : 12 : 9, will have profits set aside . . .	1136.973

Whereas, on the latter plan—making the *claims* the increase of profit, in place of the *realized profit*, and distributing it in the ratio of amount contributed, as explained in article LI.—we should have had an *equal amount* of calculated profits to belong to *each policy*, though the different policy-holders have paid the following very different sums into the capital stock of the company :—

At the end of 21 years, on a policy for £1000,

A, aged 20, will have paid of premiums with interest . . .	£643	13	1
B, aged 40, do. do. do. . .	1003	0	5
C, aged 55, do. do. do. . .	1665	2	9

From the above view of the *relative sums* contributed by A, B, and C, to the capital stock of the company, it must be abundantly evident that no principle of division *can be correct* which *disregards the relative amounts paid up by each of the partners*.

LIV. The equity of the above principle of allocating the realized profits of a life insurance institution must be still farther evident, if we reflect that the gross fund of profit is but little affected by any excess in the

average mortality which has taken place during the seven years prior to the investigation. The great source of profit may safely be held to arise from the rate of interest obtained from the investments of the annual premiums being considerably above the rate at which the premiums have been calculated. For instance, the Scottish Equitable Life Assurance Society state, that their whole capital is invested so as to yield, on an average, 5 per cent. Many other Scottish institutions have stated to the public their investments yield, on the average, 4 and $4\frac{1}{2}$ per cent. As the premiums of almost all the mutual insurance institutions are computed at *three* per cent. interest, and founded on the assumed mortality at Northampton, it follows that the difference of interest realized by the office, being *higher than* the rate on which the scale of life premiums has been computed, must increase the bonus fund to the same extent. Indeed, a scale of premiums might be deduced from the data that the office realized 5 per cent. on the amount of premiums invested, and that the mortality was, in the ratio, at all ages, as experienced by the Equitable Life Office. This scale of premiums, so computed, would differ from the scale usually adopted by the existing mutual life assurance associations, to the extent that they would measure the future reversionary interests in place of being kept up, as at present, as a theoretical measure of the original sums named in the policy.

LV. But some writers contend, that the conversion of the *present sums* of ascertained profit, into reversionary future sums, payable on the death of the party named in the policy, is objectionable *in principle* altogether. They represent that the conversion of present sums into reversionary sums ought not to form an essential part of *any plan* of distributing the realized profits of a life insurance institution. And, accordingly, the later mutual insurance institutions are so sensible of this weak point in the constitution and by-laws of the older companies, that they have declared *annual* divisions and application of profits, essential to the *equity* of the transaction altogether. The advocates for annual distributions contend, that, by admitting a contrary mode, they do violence to the acknowledged principles on which *all* division of profits amongst the the partners of ordinary copartnerships proceed; that, practically, the plan of converting present sums into reversionary benefits, does injustice to the good sound lives, who could be re-insured with any company, whilst the unsound and diseased members, alive at the period of division, obtain reversionary benefits, which they could not obtain in exchange for their present sums of profit, with any present institution. It is quite clear the present sum can only be viewed as a premium to insure the larger sum at death; and therefore the soundness of the life should be ascertained, irrespective of its having been *previously* accepted by the office.

LVI. The plan of giving *small present benefits* to the assured, in place of *large* reversionary sums, it is contended has this advantage, that *new entrants* are admitted *on fair and equitable principles*. New entrants may, themselves, become bad lives in a few weeks after their admission; and, therefore, they have no right to complain that diseased lives are on the books of the society, at annual premiums corresponding to the rates exacted from new entrants of sound constitutions. But diseased lives have no equitable claim for *additions to their policies* after they have become so diseased, at the same ratio of single or annual premiums demanded from new entrants, being sound, select lives. The new entrants into any life office are subjected to a scrutiny the most rigid as to their present state of health, habits of life, and other particulars. After undergoing a medical examination on behalf of the office, they are admitted into the society of the assured; and, in consideration of a sum paid down, to be annually continued, their representatives are assured the receipt of a *reversionary sum* at the period the life assured fails.

LVII. From the above narrative, it must be apparent that a life office *sells reversionary sums* only to *proved and tried good lives*, when the purchaser is of the *class of new entrants*; and why the *conditions of sale* should be so totally different when the purchaser is an *old*

existing insurer is not very evident. It is said that the *parade of bonuses* regulated in their amount according as the life shall lapse during *this* or *that* year, and *vest* after this or that period, may be reduced to this simple explanation, that *all* lives, good or bad, on the books of the company, shall obtain reversionary sums for present or annual annuities *on the same terms*. If the good lives do not object to the conditions of sale, it is quite clear the bad lives have a direct interest to accept of *postponed* in place of *present benefits*.

LVIII. Viewing the subject of life assurance *as a science*, there are certainly grounds for impeaching the equity of the principle of converting present ascertained profits into reversionary sums. At the various triennial, quinquennial, or septennial divisions of profits, it is quite certain a large proportion of the assured will have become, through accidents, diseases, bad habits, and other causes, *bad lives*; that is, lives who could not obtain from another company a policy on the same rate of premium with the *new entrants* who undergo medical examinations. To give reversionary sums, therefore, in return for present ascertained profits, of *equal amount to all lives on the books of the office*, without selection or distinction as to soundness of constitution, habits, or otherwise, appears certainly to do violence to our recognised notions of equity. To view it as a matter of *profit and loss*—in which view the subject will admit

of only one notion—it appears clear that, were only the *creators of the profits*—namely, the long livers—made *sole receivers* of the profits, instead of a great portion being drawn off by the *short livers*, a much *greater amount* of profits, by the *greater number of annual allocations* of present benefits, would fall and belong to the *old* existing policies than could possibly belong to them under the system presently acted on by the old bonus offices.

LIX. Whilst this work has been passing through the press, an association has been formed in Edinburgh, under the designation of “The Scottish Provident Institution,” the formators of which—seeing this *weak point* in the principle of the old bonus offices—have attempted a remedy by adopting the following plan:—They are to open a deposit account in the name of each separate assurer. To the credit of this account they are to carry the amount of single or annual premiums received under the particular policy, and improve the account by the annual addition of interest at the rate of four per centum per annum. Should the life fail *previous* to the sum at the credit of the policy being equal in amount to the *sum* in the policy, no addition whatever in name of bonus is to be added to that policy. The original sum mentioned in the policy is alone to be paid. But should the party outlive the period when the amount at the credit of the account exceeds the

sum contained in the policy, the party so assured, from the period the amounts are *equal*, is to be admitted on the list of participants in the profits of the association.

LX. If the reader has at all followed the author in articles LVI., LVII., and LVIII., it must be evident to him that the above plan is very defective, and does not at all remedy the alleged grievance—nay, perhaps, does more injustice to the assured than the plan the formators of the Scottish Provident intended to remedy. It is quite clear, that, on the above plan, all lives which fail *within* the *twelfth* or *fifteenth* years will get no share of the annual profits made by the society from *fortunate investments, forfeited policies, non-decrement of life, and other causes*. They must wait until the period when the rate of interest at 4 per cent. has improved their premiums to the sums in the policies. Suppose a life office invests its monies in the purchase of reversions so as to yield them *ten* per cent.—and this is not equal to the average of insurance profits, or the ordinary profits made in reversionary purchases—the policy-holder ought, in equity, to be admitted on the list of bonus participants, the moment the amount received under his policy, *added to the amount of annual profits made by the society*, shall have equalled the amount in the policy. On the principle adopted by the above Society, all the expenses of the establishment, losses, &c., must be borne by the unfortunate class

of insurers who live *too long* for their equitable rights, and not *long enough* to be admitted, *on the four per cent. augmentation principle*, amongst the favoured bonus participants. It is not probable, however, the plan, without an equitable alteration, will meet with public support. Besides, it is *retrograding* in the science to give *realized annual profits* to parties who have, *in equity*, no exclusive claim whatever to receive them.

LXI. A plan intended to improve on the old equitable system, is adopted by the National Life Assurance Company of London, which plan is both more equitable and more scientific than the plan adopted by the Scottish Provident. The National fixed that no division of profits should take place until the *end* of the *fifth* year, and, after that period, one-fifth of the realized profits should be divided *every year*. The effect of this mode of distributing the profits realized by the Company will be, that the mortality will obtain an *average* of five years, joined to the advantage of, ever after the first five years, *an annual distribution* of the realized profits. These realized profits, again, are given in *present benefits*, not in *reversionary sums*. The only part in the plan of the National not susceptible *of proof*, as an improvement on the old system, is, that they give so many years' purchase of the annual premium, viewed as an annuity due to themselves, for

a price equal in amount to *all* policy holders, whether diseased or sound lives, which is only doing the same thing *in effect* as purchasing an annuity from a bad life, at the price allowed to a proved selected one.

LXII. The plan of an *annual* distribution of profits is, however, affirmed to be a great improvement in the science. The Scottish Equitable and Scottish Amicable have given to the world the benefit of an attack and *defence* on the principles of short or long periods, in distributing the bonus funds of their respective institutions. The Scottish Equitable Life Office, as an inducement to their assurers to surrender some vested rights, and also as an inducement to the public to prefer that Company to existing institutions similarly constituted, but who are bound to *septennial* divisions of profits, proposed to alter the constitution of the Company, and make *triennial* in place of septennial allocations of profits. The directors of the Scottish Equitable, fearful of the soundness of short periods of allocating profits, submitted certain queries to Professor Babbage. Mr Babbage declined the employment, and recommended the queries should be laid before Professor de Morgan.

LXIII. The following are the queries and the Professor's answers :—

“1. Whether he conceives a period of three years to

be a proper and safe interval for making the investigation and allocation of profits, as proposed in the report?

“2. Should he think a period of three years too short, what does he conceive to be the shortest possible period compatible with safety?”

ANSWERS.

“ These questions appear to have been put under an impression that long intervals of division are more safe than short ones. I am entirely of a contrary opinion : the investigation being properly conducted, the shorter the intervals at which profits are divided the more secure is any society, and this Society in particular.

“ 1. Because frequent divisions require frequent examinations into the affairs of the society, I am entirely of opinion, that an examination, as *for a division of profits*, should take place every year, whether an actual division be made or not.

“ 2. With regard to this Society in particular, the more frequent the divisions are, the safer is the Society. For its principle is—1. The determination of the surplus which actually has accrued in the period elapsed, and (with a reservation) its division accordingly. 2. The hypothetical determination of the surpluses which will be created in the several years ensuing, up to the next period of division and addition to the policies

which become claims in the interval. That is to say, the Scottish Equitable Society does in fact attempt a yearly division, calculating for every seven years, and *interpolating*, as the mathematicians say, for the intermediate years. Hence it is evident, that, however just the hypothesis on which the prospective additions are made, it is still an hypothesis, and the shorter the time it is allowed to work before it is corrected by a new valuation, the better.

“ I turn the question, therefore, and ask—Is three years *too long* an interval? I am of opinion that it is not, *for safety* : but, considering that it does in fact amount to an attempt at a mathematical simplification of the process of yearly division, I do not see why a real yearly division should not be adopted. It is only a question of more or less arithmetical work in the office which is to be considered ; and I am convinced that yearly valuations are not matters of very great difficulty. At the same time, if the prospective additions be prudently calculated, three years is not unsafe from its length.

“ The notion that long periods are safer than short ones arises, I have no doubt, from forgetting that the proposal of short periods does not imply that as much is to be added to each policy as would be added at the end of a long period. If I divide yearly, I must count upon adding every year only a properly estimated fraction of what I could add septennially.”

CHAPTER VI.

CONCLUSION.

LXIV. WHILST this work was in progress, various novel features in life assurance contracts have been adopted by existing life assurance institutions, or are proposed to be embodied in the constitutions of newly projected companies. One existing London life institution proposes to allow *one half* of the premiums, exigible for the first five years, to remain over unpaid; and, should it be the intention of the assured, at the expiry of the said period of five years, to forfeit the policy, no claim is to remain with the company to exact the sum so left with the assured. By referring to the diagram of the voyage of life, and laying off the *annual risk*, which, by the experience of the Equitable, a life office sustains *during the first five years of any policy*, and comparing this amount with the sum exacted by the life office, it will be found that, in all cases, the office is quite safe in entrusting the assured with half the life premiums, *computed as for the whole voyage of life*. It must be quite evident that no office can sus-

tain a *loss* from surrendered policies, however numerous; and, therefore, so long as an office exacts premiums sufficient to cover the *annual risks*, and yield, besides, a profit equal to the expenses of management, such an office is quite safe in lending the *difference* between the annual risks for the period of the first five years, and the premiums for the whole voyage of life, taken on one uniform scale of premium throughout life. A company also must be quite safe in departing from any right to exact payment of the sum so left in the hands of the assured, in the event of the policy being surrendered; because they have been paid for the risk they have run prior to the surrender of the policy, and, therefore, they have no claim, *in equity*, for any larger sum.

LXV. A company which has just issued a prospectus in London, under the name of the National Loan Fund Life Assurance Society, propose to lend to the assured *two-thirds* of the amount of life premiums paid up to the company; but this only *under certain guarantees*. It is quite apparent that this plan does not materially differ from the other one just alluded to, unless it be the difference of *an additional loan* beyond the safety amount on the policy, *under a guarantee*. The existing life assurance societies will all make advances on policies, on receiving security; and, therefore, there is hardly any novelty in this feature of the

proposed establishment. But the projectors of this new company claim the discovery of a *new principle* in life assurance, which they thus distinguish :—" To remedy the defects of the present system, the application of a new principle is required—viz., to make the advantage derivable from an annual saving, or accumulation, contingent on two or more chances—death, or misfortune, during the lifetime of the assured. In the one case, the benefit would reach the survivor; in the other, it would commence in favour of the assured himself at the very point of permanent or temporary embarrassment." Had this new company followed out, in their prospectus, and shewn the public, *in figures*, what amount of relief or benefit they intend should reach the assured himself " at the very point of temporary or permanent embarrassment," we should be able to judge whether they have really discovered any *new principle* or not in the science of life assurance. But the third section of their plan contains the whole of the new principle; and it runs thus :—" *Thirdly*, in the event of inability to continue his payments, such other equitable disposition of his interest in his policy will be allowed as he may choose." Throughout this third article we look in vain for any other principle than this—that the company will purchase up their policy, and give an *equitable value*. This is hardly a *new* discovery, as all companies *profess* to give *equitable values* for the surrender of their policies. The projectors of the

company ought to tell us how they mean to compute these equitable values, and whether they are to give the *office values*, or the true mathematical values, computed on the data used in fixing their scale of life premiums? The Scottish Widows' Fund are far more precise. By the sixth article of their deed of constitution, should a party wish to surrender his policy, the directors are taken "bound to receive the said surrender, and to pay to the party, in consideration thereof, a sum equivalent to the net value of the expectation under the said certificate—that is to say, the excess of the value of the provision secured above the value of the future annual contributions payable thereby, and under deduction always of one-tenth part of the said net value."

LXVI. Institutions have to apprehend most danger from their new rivals adopting equitable principles in the purchase of policies. Hitherto life offices have taken a *gross advantage of misfortune*—that is, a party who was under the *necessity* of surrendering a life policy was never, hitherto, allowed from the office a fair consideration for the surrender. The principle of returning the amount of premiums received, improved with their annual interests, under deduction of the amount of annual risks, and a proportion of the expense of management, has never, hitherto, been conceded by life offices, as a *right* the assured have to

expect from the assurance company. It has been stated to the author, by more than one lawyer of eminence, that a court of equity would probably enforce the obligation usually inserted in a policy, "that the interests of the assured would be purchased up, *at its fair value*," to the effect of ordaining the office to pay, not an *office value*, but a *true* mathematical value. A court of equity, it is supposed, would not allow an office to declare on the back of the policy one principle of valuation, and *act on another principle* when they came to receive a surrender. One London life office has the boldness to endorse the *office value* on the back of their policies. A party aged twenty-eight, opened a policy for £1000 with this office, and conditioned to pay £9 : 6 : 3 *half-yearly* during life, to receive £1000 at death. On the back of the policy, the following indorsement appeared:—"Schedule of rates at which the interest of the assured in this policy will be purchased, on the days hereunder specified:—

After receipt of the 5th annual Premium	.	.	.	£0	0	0
After receipt of the 6th do.	.	.	.	0	0	0
After receipt of the 7th do.	.	.	.	0	0	0
After receipt of the 8th do.	.	.	.	23	16	8"

Here is an instance where a life assurance company actually proposed to allow *nothing* for the surrender of a policy *seven years old*, on which premiums, without computing interest, to the amount of £130 : 7 : 6, would, at the period of paying the *seventh* annual premium, have been advanced.

LXVII. Notwithstanding the want of a *definite amount* of value, to those unable to keep up their policies, the plan of the National Loan Fund Life Assurance Company must be hailed with satisfaction—viz., the concession of the principle, that a policy holder may *safely* be made banker to the association to the amount his computed premiums exceed the amount of risk run by the office from year to year. Various offices have been in the habit of giving advances to the amount of the *office value of the policy*; but this does not meet the principle nor the equity of the accommodation. On this principle, the above Life Office of London would have lent £23 : 16 : 8, on a policy of £1000, *after* it was eight years old. The growing competition amongst rival life insurance establishments, is, no doubt, destined to produce a revolution in this matter amongst all the old offices. In article XLIII., it will be remembered, the old offices were accused of want of regard to their own interests, in not pursuing the science of life insurance through-out all its bearings, so as to have discovered the possibility of the assured being *safely* made the bankers of the company, to a large extent of their individual contribution fund of premiums. On this principle, it was there shewn, the *ascending scales* of life premiums were entirely founded, and on the soundness of that principle alone could they be safely acted on.

CHAPTER VII.

OBSERVATIONS ON HEALTH INSURANCE.

LXVIII. PREVIOUS to the investigation by the Highland Society of Scotland, in 1823, no general inquiry had been instituted with a view to ascertain *the proportion which the period of health bore to the period of sickness*, and the operation of *sickness* on the decrement of life, or *force of mortality*, amongst the labouring classes. It is supposed, however, the attempt made by the Highland Society of Scotland was not quite successful. A sufficient number of facts on which to place a reasonable reliance was not obtained. The inquiry was, therefore, resumed by the Society for Promoting Useful Knowledge; and sets of schedules were sent to friendly societies in most of the counties of England. Returns were received, taken indiscriminately, from all parts of England, while passing through 24,323 years of life, principally between the ages of 20 and 70. Mr Ansell, the learned actuary to the Atlas Assurance Company, who prepared the

treatise on friendly societies, embracing the returns obtained by the Society just alluded to, states, as the result of the Scotch and English inquiries, that "the close agreement as to the *relative* rate of sickness, at all the ages embraced in the term compared, is a fact strongly tending to establish the credit of both tables, although the *actual* quantity of sickness shewn in the Scotch table is considerably less than the actual quantity experienced amongst the English societies." Mr Ansell is of opinion that computations, based on the data obtained in Scotland, are, from the above circumstance, "quite inapplicable to the purposes of societies in England."

LXIX. Mr Edmonds, B.A., late of Trinity College, Cambridge, published, in 1832, a new theory of the causes producing health and longevity. He states, that he has collected facts which incontestably prove that death is proportional to *duration of sickness* alone, irrespective of the *intensity* of the disease of which the party died. These observations are stated to have been made over *military masses* of the greatest magnitude, and under the widest variety of circumstances—that among any considerable quantity of men, placed for a given time under peculiar circumstances, there will exist a fixed proportion between the number of deaths and the aggregate duration of sickness. *Two years of sickness to each death*, appears to be the law

of nature, from which little deviation was perceived, except in very unhealthy climates. The experience of benefit societies in England gives very nearly two years of sickness to each death. In the army, stationed at home, and inactive, the proportion is about $2\frac{1}{2}$ years sickness to each death. In the English West India army, the proportion is increased to $1\frac{1}{2}$ year of sickness to each death; whilst, amongst the European troops stationed in India, $1\frac{1}{2}$ year of sickness is the average of the experience. Taking the experience of the Peninsular war, the sickness observed to rule over the deaths was about two years. It is averred, that, in any population between the ages of 20 and 55, if the numbers constantly sick amount to *four per cent.* on the living, then it may be safely inferred that the annual deaths will amount to *two per cent.*

LXX. Although the *average* proportion of *two* years of sickness to each death, seems to be the law of nature, still it must be quite apparent that the rate of sickness will increase with the rate of mortality. This position is incontestably proved to exist, both by the results obtained by the Highland Society of Scotland, and by the investigations of the Society for Promoting Useful Knowledge, made throughout all the English counties. It follows that the premiums for health insurance ought to be on ascending scales of amount, corresponding with the *ages* of the members who

secure, by weekly contributions during health, a claim to weekly allowance during sickness. The *ability* on the part of the Society to pay the benefits stipulated, will evidently flow from the certainty that the number whose duration of sickness exceeds the average proportion, will be compensated by the number whose duration of sickness will fall *below* the average. The average here stated is fixed on the principle that all the individuals are of average formation and constitutions—that is, are not maimed in any important member necessarily instrumental to the performance of the labour in which he is engaged, and free from any affection of his vital organs, such as diseased lungs.

LXXI. The average contribution, fixed by the authority of the Highland Society, proceeds on the assumption that *selection* is applied to the candidates for admission; and in the report made by that Society it is stated, that, from a census made in the parish of Methven, Perthshire, it was found that one, or nearly one, out of every *twenty-one* males, above 15 years of age, could not, at any period of their lives, have been admissible into any friendly society. This scrutiny, besides, was not so rigid as happens daily in the military service. The result of the inquiry in the parish of Methven is corroborated very strongly by the return of the number of recruits to the army, inspected at Glasgow, between the years 1817 and 1823 :—

The numbers inspected were,	613
Of which were deemed fit for service,	506
Rejected as unfit,	107
	<hr/> 613

The important point to be considered by all friendly societies, and by the government, as the *moral* and *legal* patrons, from the foregoing observations, is this—whether a set of tables ought not to be fixed, and approved, and recommended by government to be used; the calculations to be founded on the supposition that the friendly society is to admit *exceptionable lives*. By *exceptionable lives* is meant, that, where a wife and family are, *bona fide*, dependent on the continuance in health of a mechanic, who is, *generally*, able to attend to his daily employment, and create *savings*, whilst he enjoys *health*, such a class of persons should be admissible, government paying the deficiency or loss occasioned by the admission of this class to the society, as the agreed on price of a copy of the records of the benefit society for the past year. The sum voted by government might be justly viewed, more as the price of the society's records, than a contribution to a charity fund.

LXXII. An important fact, elicited by the inquiries into the relative duration of health and sickness is this—that all *savings* from the earnings of labour ought to be made before the age of 55. Between the ages of 55 and 65, a man should not attempt to labour more than creates what is barely sufficient to maintain him-

self. After the age of 65, a man ought to cease from labour, and subsist entirely on previous savings. On this great principle, the two following tables are founded. The health insurance thermometrical Table (I.) terminates at the age of 55, and is computed on the principle that the member enters as for a continuance to that age, and, each year, is to pay *one uniform rate* of contribution, to receive a weekly allowance of 100 pence during sickness. It need scarcely be pointed out that *double* the contribution will entitle to *double* the allowance. Table II. is constructed on this principle—that, as the risk of sickness increases from year to year, in proportion to the *risk* of mortality, so a variable and increasing rate of contribution from year to year, for the term of one year, at all ages, would indicate a fair *increasing* weekly payment, to be exacted by a benefit society, in return for an obligation to grant one uniform sum of 100 pence to each member, without distinction of age, during sickness.

LXXIII. It is very probable that the scales of contributions here given may be found inapplicable to the next generation. Much lower rates may suffice. The changes which are, at short intervals of time, introduced as political improvements affecting the labouring classes—such as the Factory Bill, Poor-Law Bill, and others of a similar nature—are not limited in their influence to the immediate and visible effects which they

TABLE II.

Increasing Weekly scale
of Contribution to receive
100 Pence $\frac{1}{4}$ Week for one
year, until 70

Ages.	Weekly Pence payable
70 & 71	93
69 & 70	90
68 & 69	85
67 & 68	86
66 & 67	85
65 & 66	84
64 & 65	79
63 & 64	74
62 & 63	54
61 & 62	98
60 & 61	47
59 & 60	99
58 & 59	55
57 & 58	74
56 & 57	76
55 & 56	41
54 & 55	08
53 & 54	96
52 & 53	25
51 & 52	73
50 & 51	63
49 & 50	52
48 & 49	42
47 & 48	32
46 & 47	22
45 & 46	13
44 & 45	04
43 & 44	95
42 & 43	86
41 & 42	79
40 & 41	70
39 & 40	62
38 & 39	54
37 & 38	47
36 & 37	40
35 & 36	33
34 & 35	26
33 & 34	19
32 & 33	13
31 & 32	07
30 & 31	01
29 & 30	95
28 & 29	89
27 & 28	84
26 & 27	78
25 & 26	73
24 & 25	68
23 & 24	63
22 & 23	59
21 & 22	54
20 & 21	49

TABLE I.

Uniform Weekly scale
of Contribution to receive
100 Pence $\frac{1}{4}$ Week dur-
ing Sickness until
55.

Ages of admission	Weekly Pence Payable.
54	08
53	02
52	96
51	90
50	84
49	78
48	72
47	66
46	60
45	54
44	48
43	42
42	37
41	31
40	25
39	20
38	14
37	09
36	04
35	98
34	93
33	88
32	83
31	78
30	73
29	68
28	63
27	58
26	53
25	49
24	44
23	40
22	35
21	31
20	27

Scale of Annual Con-
tribution for annuity
of £1 for life after 55
payable monthly should
the person live to that
age

Ages at Entry	Pounds & Decimals of £
50	854
49	499
48	247
47	038
46	912
45	795
44	701
43	622
42	557
41	501
40	453
39	411
38	375
37	343
36	315
35	290
34	268
33	248
32	230
31	213
30	198
29	185
28	173
27	161
26	151
25	141
24	133
23	125
22	117
21	110
20	104
19	098
18	092
17	087
16	082
15	078



produce over the branches of commerce or charitable institutions, on whom the statutes were specially framed to operate. The operations of these statutes will ultimately affect the whole frame of society. The relative proportion of time between *exertion* and *cessation* from labour; the degree in which they are supplied with food; the improvements in more effectually ventilating workshops, mills, factories—all these improvements must vary the proportion between health and sickness as presently experienced by the manufacturing population. This reduction in the quantum of sickness will diminish the force of mortality, and human life must consequently improve in duration. Thus the history of friendly societies and life insurance institutions will be intimately connected with the history of our species, throughout the varying periods of any country's progress from the rudeness of savage life to the highest period of its cultivation.

LXXIV. The importance of possessing complete transcripts or copies of the books of all friendly societies, (which is their *history*,) cannot be too much inculcated on government. The returns would enable us to ascertain, from time to time, whether the changes in the rates of sickness and mortality are attributable to natural, to political, or to moral causes. The returns for the societies of the whole kingdom, duly analyzed by a proper officer, and lodged in a proper depository,

would afford the most invaluable aid to friendly societies themselves, and would enable government to legislate wisely on subjects connected with the *labouring population*. Mr Ansell has suggested that some central register office ought to be opened for England, in London, under the protection of government, for the safe and systematic keeping of the returns above mentioned, as well as for furnishing to societies such information as, from time to time, they may desire. Possessed as Scotland is of a central register office at Edinburgh, for the records of every county in Scotland, it would be very desirable to obtain from government a chamber in the General Register House, with the services of an actuary, whose duty should be to receive gratuitously the returns from every friendly and benefit society in Scotland, and make an abstract or analysis of the whole, for the use of the government, the public libraries of the kingdom, and for the friendly societies themselves. The appointment of a government actuary for Scotland seems unobjectionable on principle, seeing that a government actuary exists in England, whose duties seem to be analogous to those so desirable for Scotland—namely, to examine and ascertain the relative mortality of past years, so as to guide government in future financial operations connected with life contingencies—such as the conversion of perpetual into terminable annuities, pensions to the retired members of the army and navy, &c.

LXXV. It has already been pointed out, on the authority of Mr Ansell, that the actual quantity of *sickness* experienced in Scotland appears, from the report made to the Highland Society, to have been considerably *less* than the actual quantity experienced amongst the English friendly societies; which circumstance, Mr Ansell states, "would necessarily render computations based on the former quite inapplicable to the purposes of societies in England." It would evidently, for the above reason, be highly unjust to mix together the experience and the returns of friendly societies in England, Scotland, and Ireland. Each kingdom should possess a register house and a proper record officer of its own. Much information remains to be obtained by government from friendly societies. Correct data for determining the rate of sickness which prevails from the age of 70 to the end of life, is absolutely wanting altogether. Also the difference in the rate of sickness which obtains among the inhabitants of towns, and persons living in agricultural districts. Returns from the various *towns* and rural *parishes* of Scotland, properly distinguished, would go far to supply the existing desiderata. An authentic copy of the recognised rules and scales of contributions of every existing friendly society ought to be lodged in the proposed chamber of the General Register House, to which the clerks of every friendly society might have free access. The deputies of the Lord Advocate for

Scotland would be enabled, at all times, by possession of those rules, to preserve a uniformity of contribution, as well as of scale of contributions for benefits, over the urban and rural districts of the kingdom.

THE END.

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